



Doc. Number :

- ☐ Tentative Specification  
☐ Preliminary Specification  
☒ Approval Specification

MODEL NO.: M270H5  
SUFFIX: LA2

**Customer:****APPROVED BY****SIGNATURE****Name / Title** \_\_\_\_\_

Note

Product Version C2

\_\_\_\_\_  
Please return 1 copy for your confirmation with your signature and comments.

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**REVISION HISTORY**

Version	Date	Page	Description
2.0	Jan.21, 2011	All	Spec Ver.2.0 was first issued.
2.1	Mar.30, 2011	Page.10	Add the LCD ELETRONICS SPECIFICATION in 60Hz mode.



## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

The M270H5-LA2 model is a 27.0" wide TFT-LCD module with a WLED Backlight Unit and 30-pin 2ch-LVDS interface. This module supports 1920 x 1080 Full HD mode and displays up to 16.7 million colors. The converter module for the Backlight Unit is not built in.

### 1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	27.0" real diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1920 x R.G.B. x 1080	pixel	-
Pixel Pitch	0.3114 (H) x 0.3114 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	AG type, 3H hard coating, Haze 25	-	-
Luminance, White	300	Cd/m2	
Power Consumption	Total 36.17 W (Typ.) @ cell 18.25 W (Typ.), BL 17.92 W (Typ.)		(1)

Note (1) The specified power consumption : Total= cell (reference 4.3.1)+BL (reference 4.3.3)

## 2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	629.5	630	630.5	mm	(1)
	Vertical (V)	367.7	368.2	368.7	mm	
	Thickness (T)	15.0	15.5	16.0	mm	
Bezel Area	Horizontal		603.91		mm	
	Vertical		342.29		mm	
Active Area	Horizontal		597.888		mm	
	Vertical		336.312		mm	
Weight			3020	3120	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

## 3. ABSOLUTE MAXIMUM RATINGS

### 3.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	-20	60	°C	(1)
Operating Ambient Temperature	TOP	0	50	°C	(1), (2)

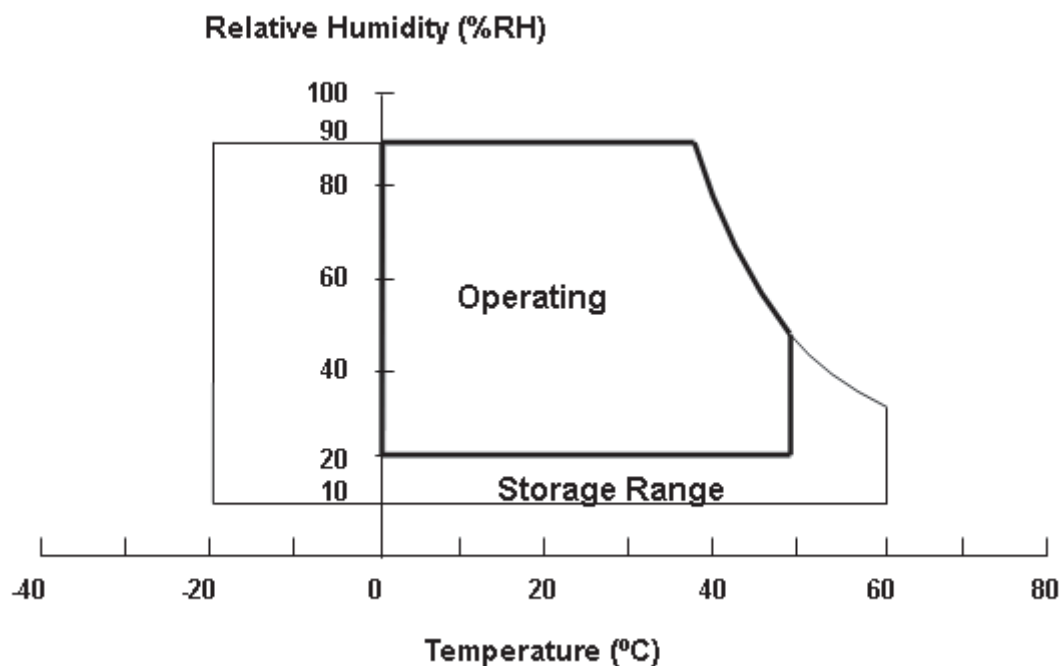
Note (1)

(a) 90 %RH Max. (Ta <= 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

(c) No condensation.

Note (2) The temperature of panel surface should be 0 °C min. and 60 °C max.



## 3.2 ELECTRICAL ABSOLUTE RATINGS

### 3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCI	-0.3	6.0	V	(1)
Logic Input Voltage	VIN	-0.3	3.6	V	

### 3.2.2 BACKLIGHT UNIT

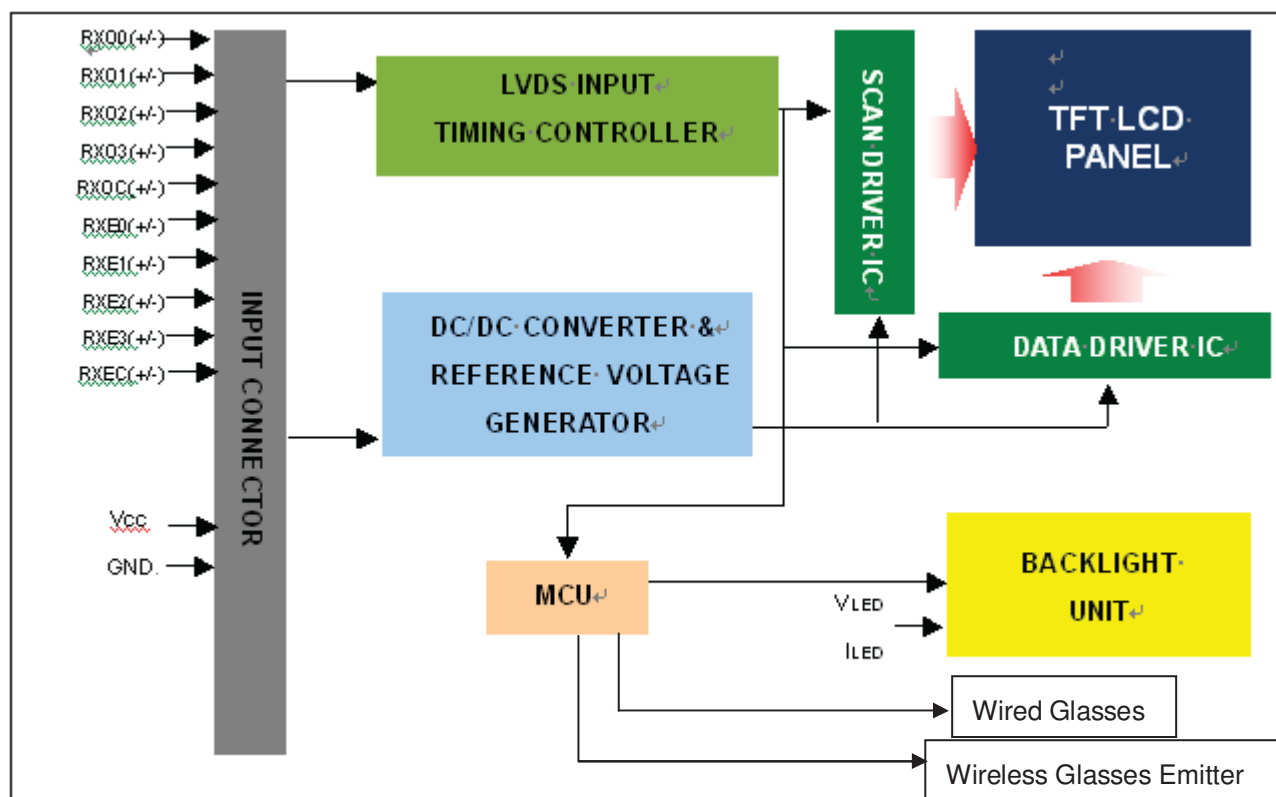
Item	Symbol	Value			Unit	Note
		Min.	Typ	Max.		
LED Forward Current Per Input Pin	IF		100		mA	(1), (2) Duty=100%
LED Reverse Voltage Per Input Pin	VR			70	V	
LED Pulse Forward Current Per Input Pin	IP			320	mA	(1), (2) Pulse Width ≤ 10msec. and Duty ≤ 10%

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for input pin of LED light bar at Ta=25±2 °C (Refer to 4.3.3 and 4.3.4 for further information).

## 4. ELECTRICAL SPECIFICATIONS

### 4.1 FUNCTION BLOCK DIAGRAM



## 4.2. INTERFACE CONNECTIONS

### 4.2.1 30PIN CONNECTOR PIN ASSIGNMENT

Pin	Name	Description
1	RX00-	Negative LVDS differential data input. Channel O0 (odd)
2	RX00+	Positive LVDS differential data input. Channel O0 (odd)
3	RX01-	Negative LVDS differential data input. Channel O1 (odd)
4	RX01+	Positive LVDS differential data input. Channel O1 (odd)
5	RX02-	Negative LVDS differential data input. Channel O2 (odd)
6	RX02+	Positive LVDS differential data input. Channel O2 (odd)
7	GND	Ground
8	RX0C-	Negative LVDS differential clock input. (odd)
9	RX0C+	Positive LVDS differential clock input. (odd)
10	RX03-	Negative LVDS differential data input. Channel O3 (odd)
11	RX03+	Positive LVDS differential data input. Channel O3 (odd)
12	RXE0-	Negative LVDS differential data input. Channel E0 (even)
13	RXE0+	Positive LVDS differential data input. Channel E0 (even)
14	GND	Ground
15	RXE1-	Negative LVDS differential data input. Channel E1 (even)
16	RXE1+	Positive LVDS differential data input. Channel E1 (even)
17	GND	Ground
18	RXE2-	Negative LVDS differential data input. Channel E2 (even)
19	RXE2+	Positive LVDS differential data input. Channel E2 (even)
20	RXEC-	Negative LVDS differential clock input. (even)
21	RXEC+	Positive LVDS differential clock input. (even)
22	RXE3-	Negative LVDS differential data input. Channel E3 (even)

23	RXE3+	Positive LVDS differential data input. Channel E3 (even)
24	GND	Ground
25	NC	Not connection, this pin should be open.
26	NC	Not connection, this pin should be open.
27	NC	Not connection, this pin should be open.
28	NC	Not connection, this pin should be open.
29	NC	Not connection, this pin should be open.
30	NC	Not connection, this pin should be open.

Note (1) Connector Part No.:

187114-30091,(P-TWO)

Note (2) The first pixel is odd.

Note (3) Input signal of even and odd clock should be the same timing.

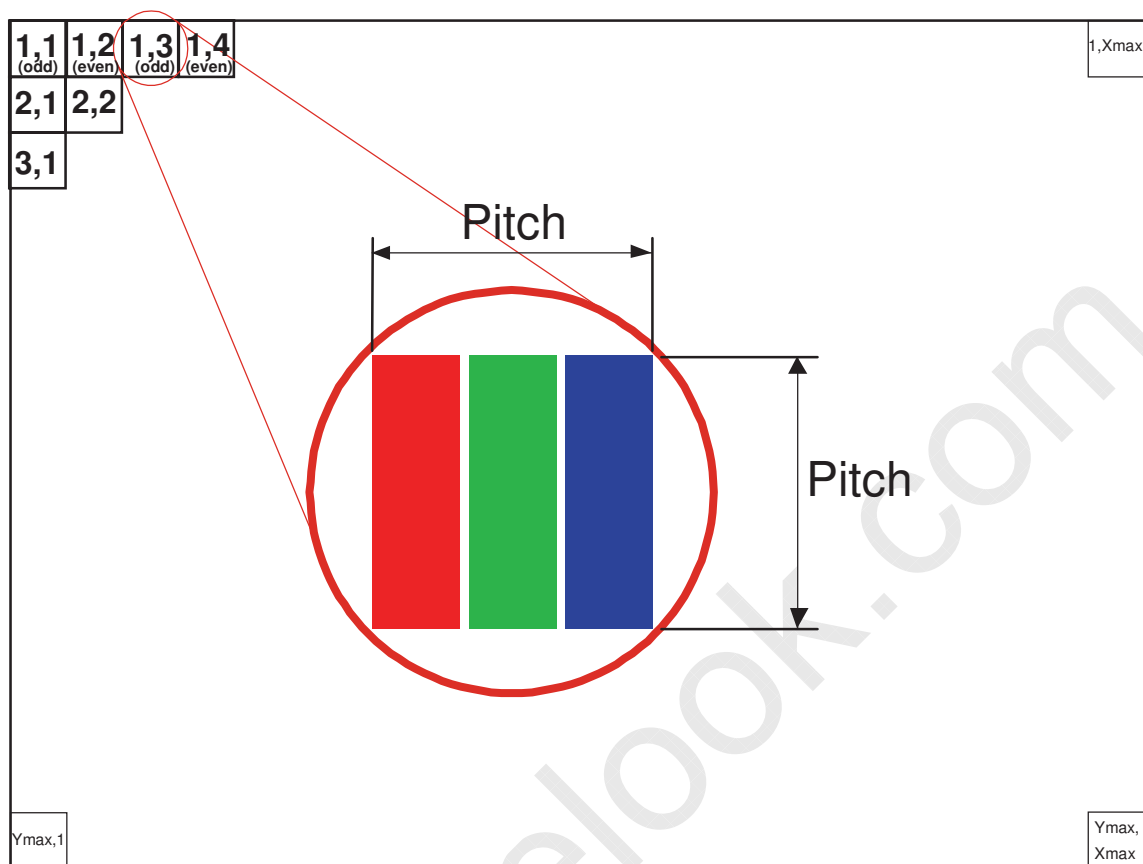
## 4.2.2 15PIN CONNECTOR PIN ASSIGNMENT

Pin	Name	Description
1	VCCI	+5.0V power supply
2	VCCI	+5.0V power supply
3	VCCI	+5.0V power supply
4	VCCI	+5.0V power supply
5	VCCI	+5.0V power supply
6	GND	Ground
7	NC	For LCD internal use only, Do not connect
8	NC	For LCD internal use only, Do not connect
9	GND	Ground
10	GND	Ground
11	GND	Ground
12	GND	Ground
13	NC	Not connection, this pin should be open.
14	NC	Not connection, this pin should be open.
15	NC	Not connection, this pin should be open.

Note (1) Connector Part No.:12507WR-H15L,(Yeonho)

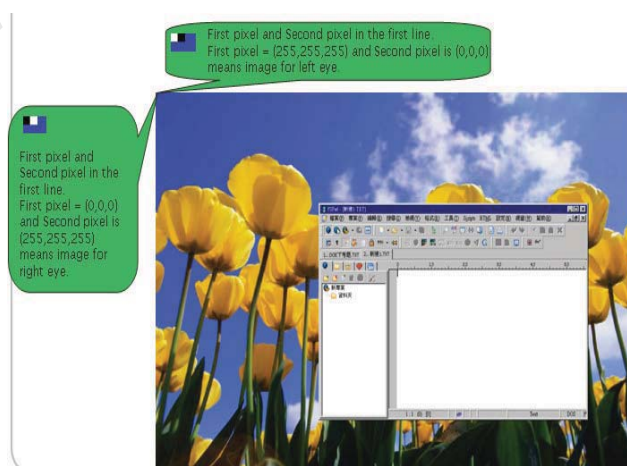
## 4.2.3 10PIN CONNECTOR PIN ASSIGNMENT

Pin	Name	Description
1	VCOM	signal for wired glasses
2	VL	signal for wired glasses
3	VR	signal for wired glasses
4	B/L	BLU Duty for 3D mode .
5	3D-Enable	Pull high when 3D mode .
6	Wireless	Carrier waveform for wireless glasses
7	NC	set as floating
8	NC	set as floating
9	NC	set as floating
10	NC	set as floating



## 4.2.4 Pixel ID Definition

The position of pixel ID is on the first pixel and second pixel in the first line. First pixel is (255,255,255) and second pixel is (0,0,0) means the image is for left eye ; First pixel is (0,0,0) and second pixel is (255,255,255) means the image is for right eye.



## 4.3 ELECTRICAL CHARACTERISTICS

### 4.3.1 LCD ELETRONICS SPECIFICATION

60Hz mode:

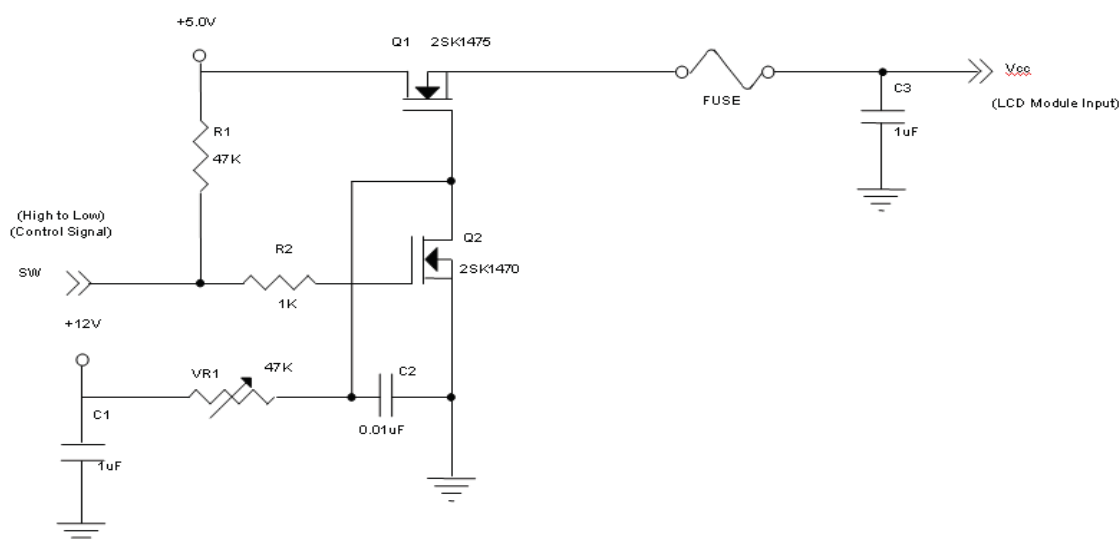
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V <sub>CC</sub>	4.5	5.0	5.5	V	-
Ripple Voltage	V <sub>RP</sub>			300	mV	-
Rush Current	I <sub>RUSH</sub>			5	A	(2)
Power Supply Current	White		0.82	1.07	A	(3)a
	Black		1.28	1.67	A	(3)b
	Vertical Stripe		1.14	1.48	A	(3)c
Power Consumption	PLCD		6.4	8.35	Watt	(4)
LVDS differential input voltage	V <sub>id</sub>	200		600	mV	(5)
LVDS common input voltage	V <sub>ic</sub>	1.0	1.2	1.4	V	-
Logic High Input Voltage	V <sub>IH</sub>	2.64			V	-
Logic Low Input Voltage	V <sub>IL</sub>			0.66	V	-

120Hz mode:

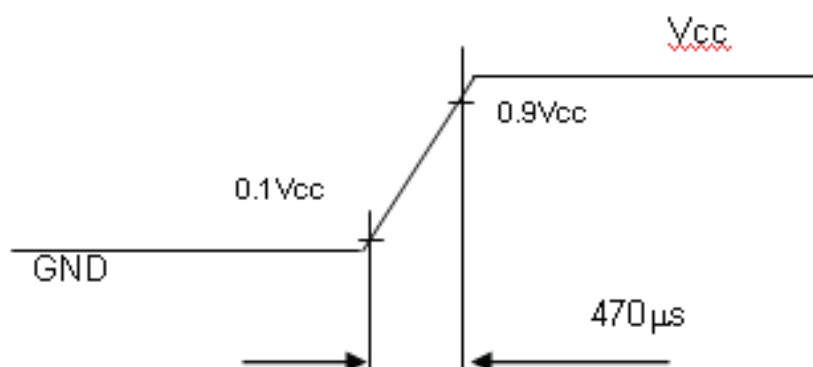
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V <sub>CC</sub>	4.5	5.0	5.5	V	-
Ripple Voltage	V <sub>RP</sub>			300	mV	-
Rush Current	I <sub>RUSH</sub>			5	A	-
Power Supply Current	White		1.3	1.7	A	-
	Black		2.8	3.65	A	-
	Vertical Stripe		2.2	2.86	A	-
Power Consumption	PLCD		14	18.25	Watt	-
LVDS differential input voltage	V <sub>id</sub>	200		600	mV	-
LVDS common input voltage	V <sub>ic</sub>	1.0	1.2	1.4	V	-
Logic High Input Voltage	V <sub>IH</sub>	2.64			V	-
Logic Low Input Voltage	V <sub>IL</sub>			0.66	V	-

Note (1) The ambient temperature is Ta = 25 ± 2 °C.

Note (2) Measurement Conditions:



Vcc rising time is 470 $\mu$ s



Note (3) The specified power supply current is under the conditions at  $V_{CC} = 5.0\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ ,  $F_r = 60\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



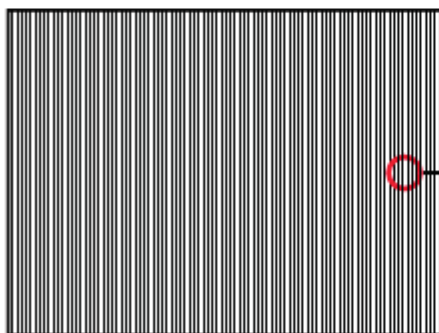
Active Area

b. Black Pattern

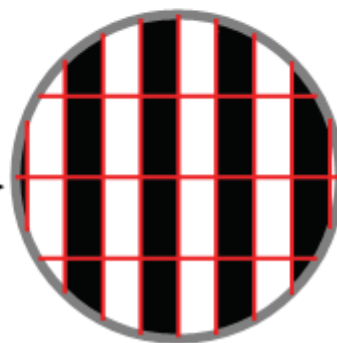


Active Area

c. Vertical Stripe Pattern



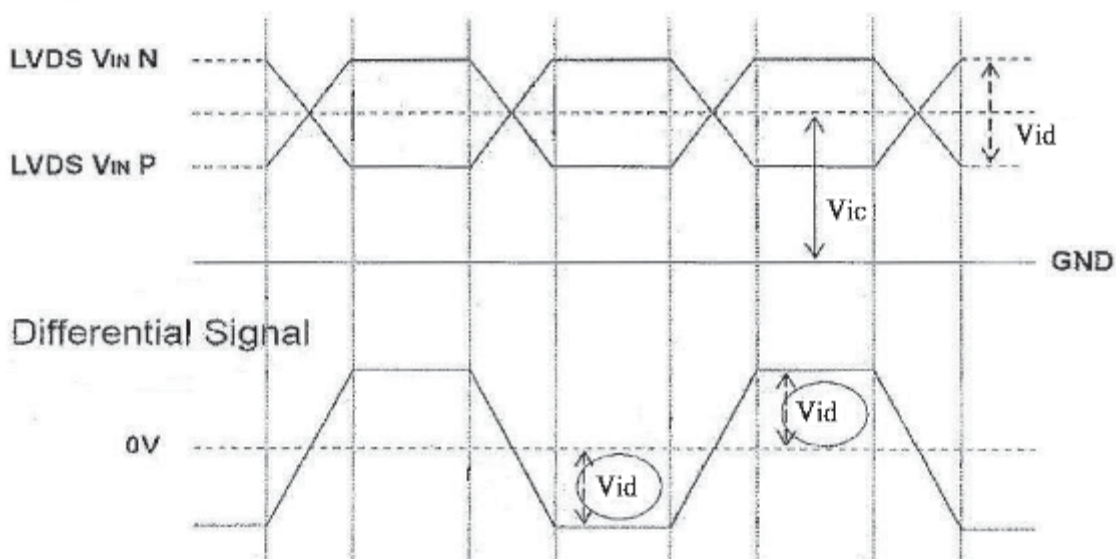
Active Area



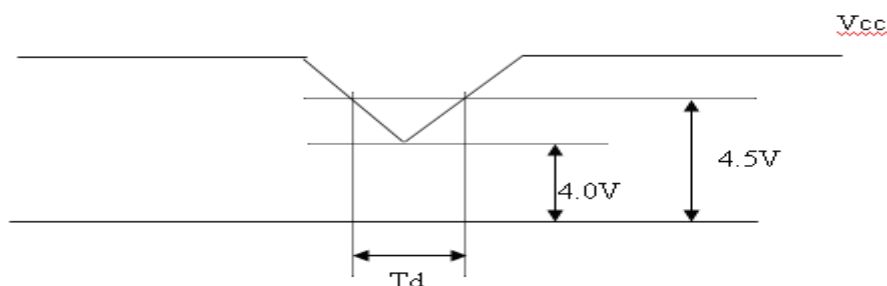
Note (4) The power consumption is specified at the pattern with the maximum current.

Note (5) VID waveform condition

## Single-End



### 4.3.2 Vcc Power Dip Condition



### 4.3.3 BACKLIGHT UNIT

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Input Voltage Per Input Pin	VPIN	39.2	44.8	47.6	V	(1), Duty=100%, IPIN=100mA
LED Light Bar Current Per Input Pin	IPIN	---	100	---	mA	(1), (2) Duty=100%
LED Life Time	LLED	30000	---	---	Hrs	(3)
Power Consumption	PBL	---	17.92	---	W	(1) Duty=100%, IPIN=100mA

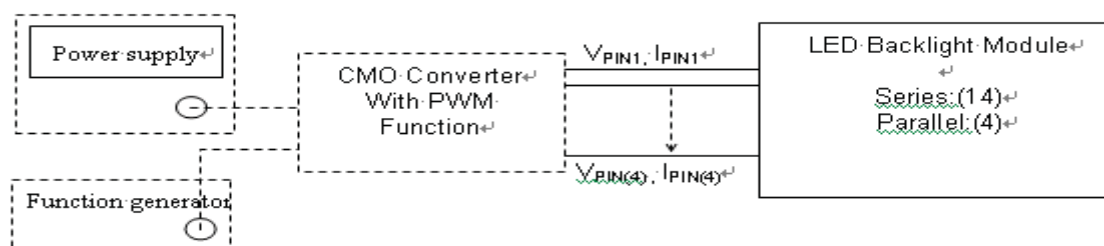
Peaking mode(reference only)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Input Voltage Per Input Pin	VPIN	---	49	---	V	(1), Duty=100%, IPIN=160mA
LED Light Bar Current Per Input Pin	IPIN	---	160	---	mA	(1), (2) Duty=18%
LED Life Time	LLED	30000	---	---	Hrs	(3)
Power Consumption	PBL	---	5.64	---	W	(1) Duty=18%, IPIN=160mA

Note (1) LED light bar input voltage and current are measured by utilizing a true RMS multimeter as shown below:

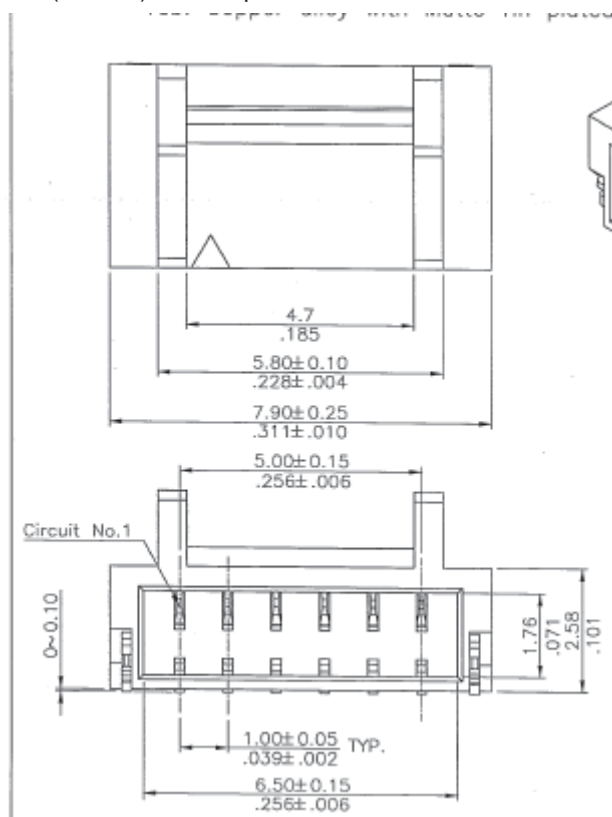
Note (2)  $PBL = IPIN \times VPIN \times (4)$  input pins, LED light bar circuit is (14)Series, (4)Parallel.

Note (3) The lifetime of LED is defined as the time when LED packages continue to operate under the conditions at  $T_a = 25 \pm 2^\circ\text{C}$  and  $I = 25\text{mA}$  (per chip) until the brightness becomes  $\leq 50\%$  of its original value.



#### 4.3.4 LIGHTBAR Connector Pin Assignment

Connector: CI1406M1HRF-NH (CviLux).or Compatible



CN1

Pin number	Description
1	Cathode of LED string
2	Cathode of LED string
3	VLED
4	VLED
5	Cathode of LED string
6	Cathode of LED string

Note (1) User' s Mating Connector Part No.: CI1406SL000-NH (CviLux) or Compatible.

#### 4.4 LVDS INPUT SIGNAL SPECIFICATIONS

##### 4.4.1 LVDS DATA MAPPING TABLE

LVDS Channel O0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	OG0	OR5	OR4	OR3	OR2	OR1	OR0
LVDS Channel O1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	OB1	OB0	OG5	OG4	OG3	OG2	OG1
LVDS Channel O2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	OB5	OB4	OB3	OB2
LVDS Channel O3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	OB7	OB6	OG7	OG6	OR7	OR6
LVDS Channel E0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	EG0	ER5	ER4	ER3	ER2	ER1	ER0
LVDS Channel E1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	EB1	EB0	EG5	EG4	EG3	EG2	EG1



LVDS Channel E2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	EB5	EB4	EB3	EB2
LVDS Channel E3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	EB7	EB6	EG7	EG6	ER7	ER6

## 4.4.2 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

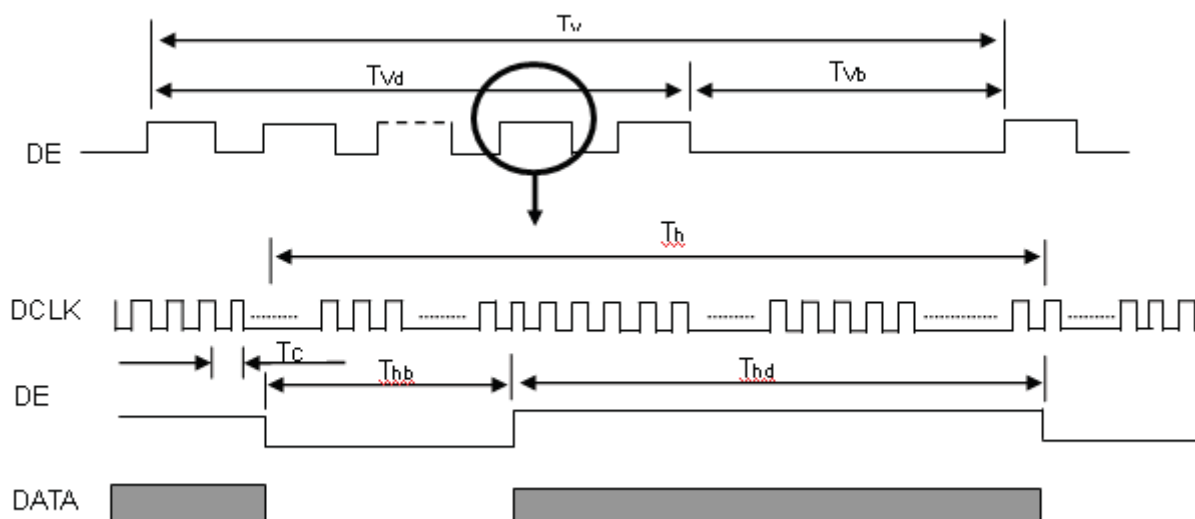
#### 4.5 DISPLAY TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

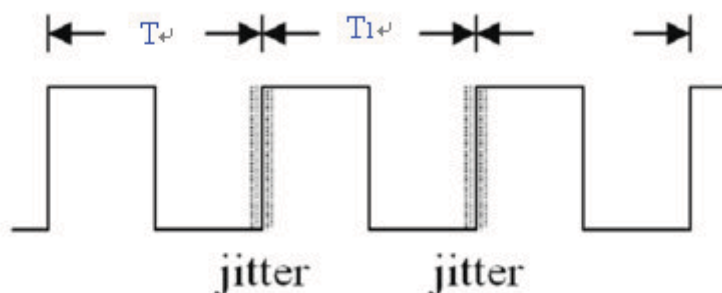
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	58.54	74.25	98	MHz	-
	Period	Tc	-	13.47	-	ns	
	Input cycle to cycle jitter	T <sub>rcl</sub>	-0.02*Tc	-	0.02*Tc	ns	(1)
	Spread Spectrum Modulation range	F <sub>clk_in_mod</sub>	0.98*Fc	-	1.02*Fc	MHz	(3)
	Spread Spectrum Modulation frequency	F <sub>SSM</sub>	-	-	200	KHz	
	High Time	Tch	-	4/7	-	Tc	
	Low Time	Tcl	-	3/7	-	Tc	-
Vertical Active Display Term	Frame Rate	Fr	50	60	75	Hz	(4) Tv=Tvd+Tvb
	Total	Tv	1115	1125	1136	Th	-
	Display	Tvd	1080	1080	1080	Th	-
	Blank	Tvb	Tv-Tvd	45	Tv-Tvd	Th	-
Horizontal Active Display Term	Total	Th	1050	1100	1150	Tc	Th=Thd+Thb
	Display	Thd	960	960	960	Tc	-
	Blank	Thb	90	140	190	Tc	-

Note: this module is operated by DE only mode, Hsync and Vsync input signals are ignored, and the table value is used for 2D mode.

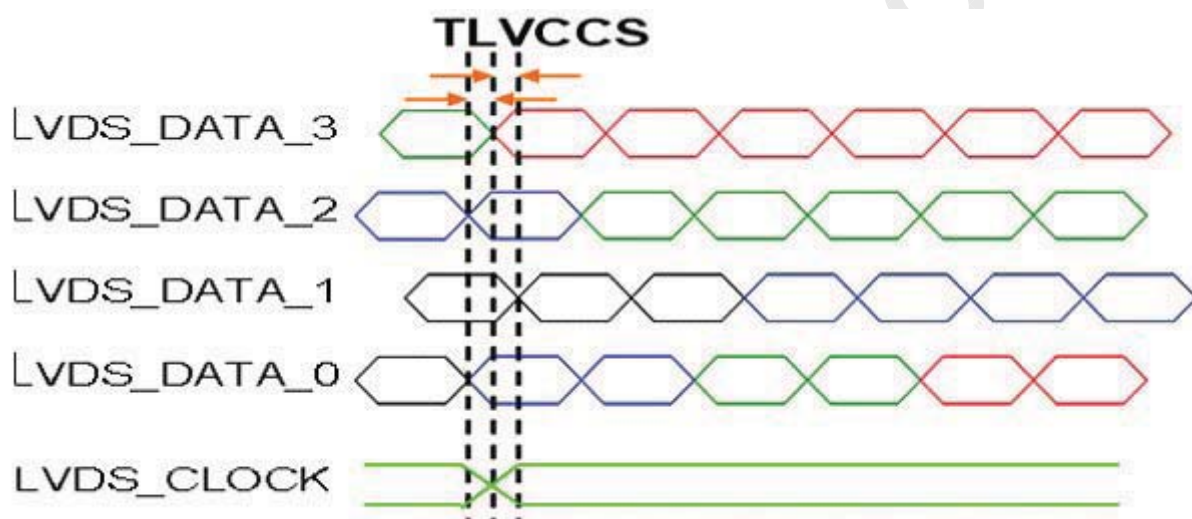
#### INPUT SIGNAL TIMING DIAGRAM



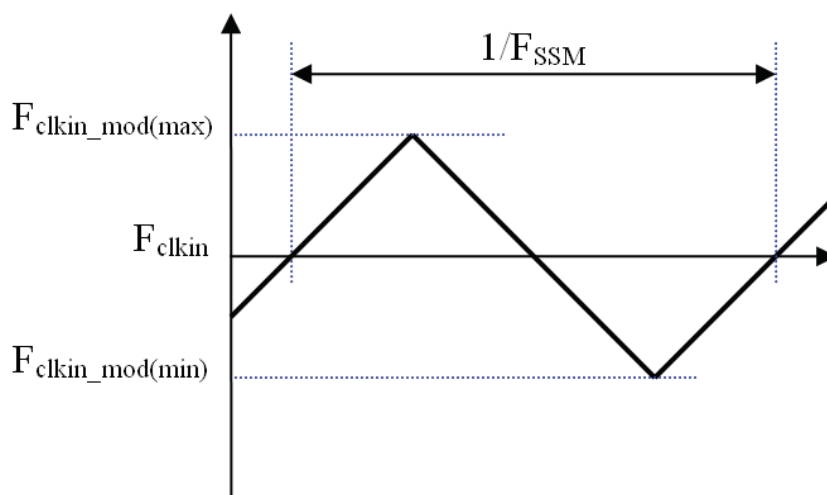
Note (1) The input clock cycle-to-cycle jitter is defined as below figures.  $Trcl = |T_1 - T_1|$



Note (2) Input Clock to data skew is defined as below figures.



Note (3) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (4) Definition of 2D and 3D mode frame Rate

3D mode (input signal with pixel ID)

When 50Hz frame rate input , the panel display is 100Hz frame rate.

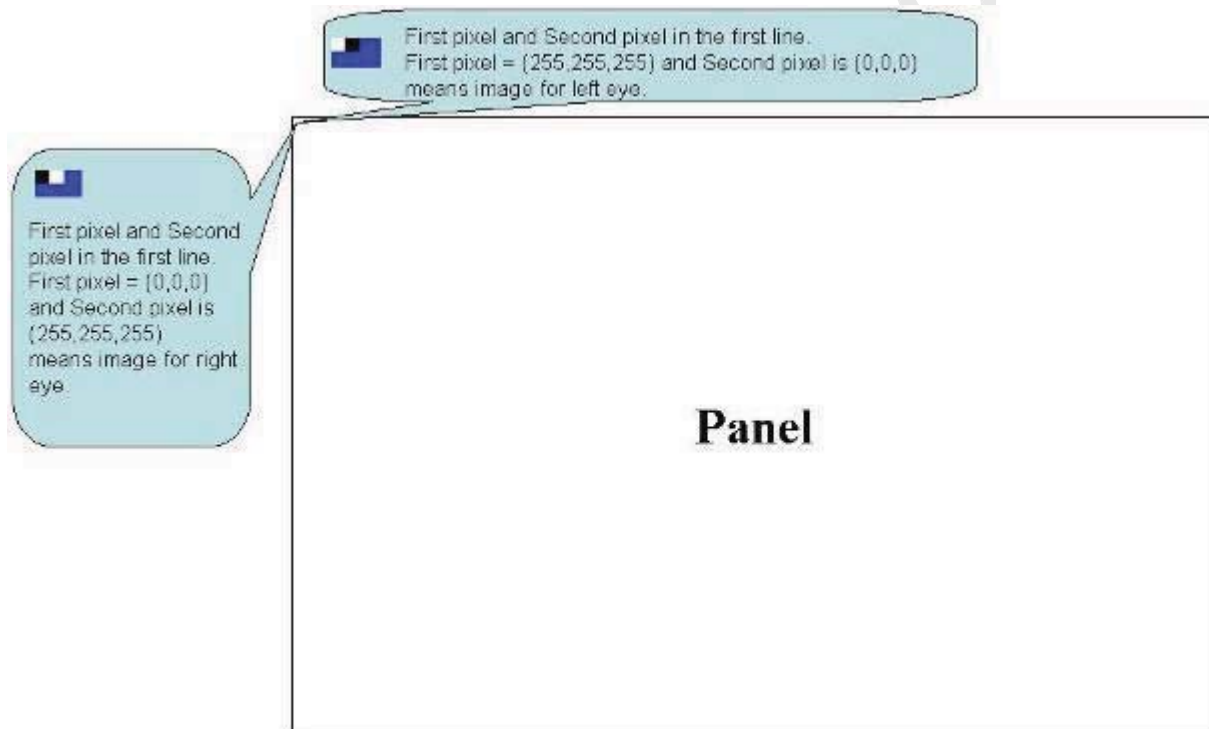
When 60Hz frame rate input , the panel display is 120Hz frame rate.

2D mode (input signal without pixel ID)

When 50Hz frame rate input , the panel display is 50Hz frame rate.

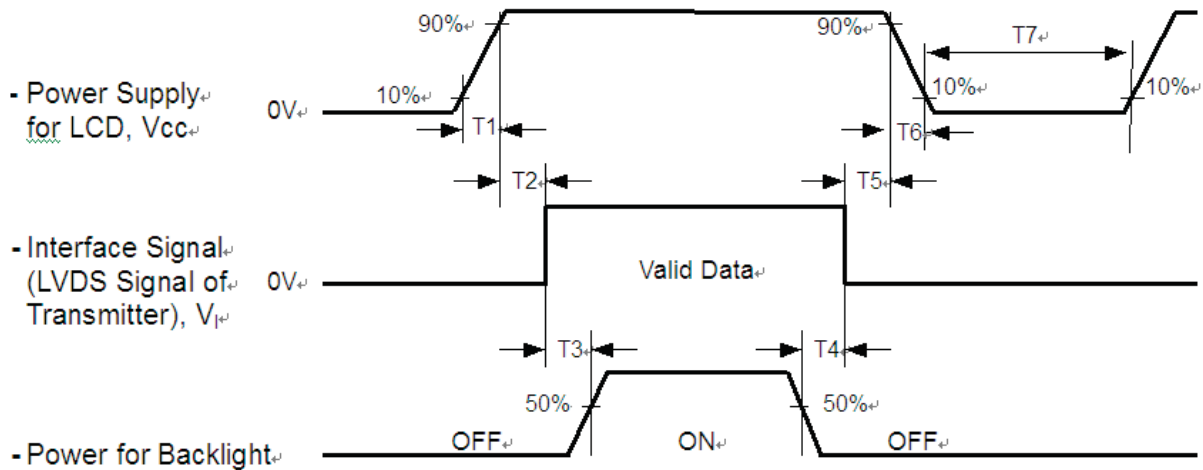
When 60Hz frame rate input , the panel display is 60Hz frame rate.

### Pixel ID describe



#### 4.6 POWER ON/OFF SEQUENCE

The power sequence specifications are shown as the following table and diagram.



Timing Specifications:

Parameters	Values			Units
	Min	Typ.	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	800	-	-	ms
T4	90	-	-	ms
T5	0	-	50	ms
T6	5	-	100	ms
T7	500	-	-	ms

Note (1) The supply voltage of the external system for the module input should be the same as the definition of  $V_{cc}$ .

Note (2) When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.

Note (3) In case of  $V_{CC}$  = off level, please keep the level of input signals on the low or keep a high impedance.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

Note (6) CMI won't take any responsibility for the products which are damaged by the customers not following the Power Sequence.

Note (7) There might be slight electronic noise when LCD is turned off (even backlight unit is also off). To avoid this symptom, we suggest "Vcc falling timing" to follow "t6 spec".

## 5. OPTICAL CHARACTERISTICS

### 5.1 TEST CONDITIONS

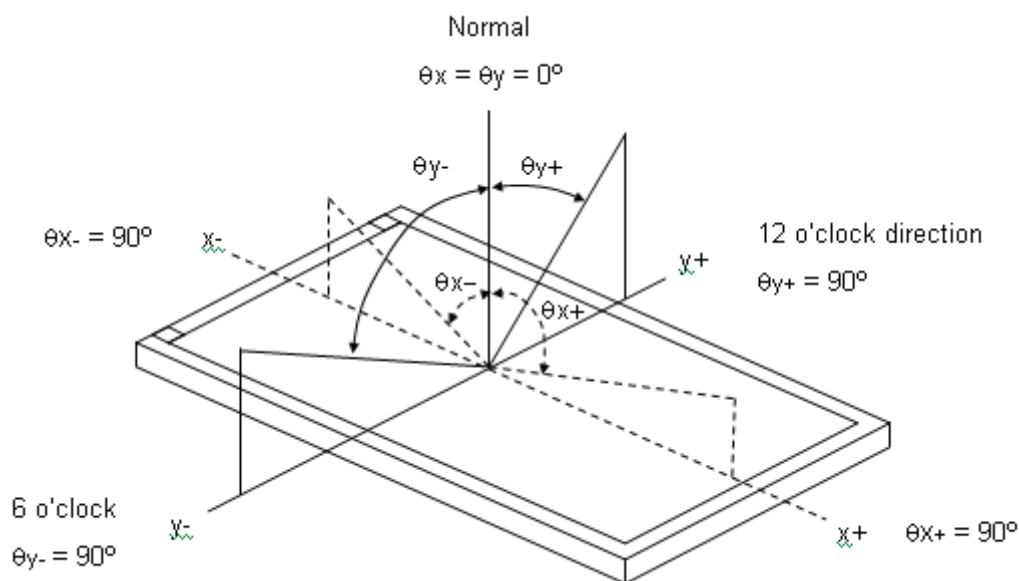
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	oC
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	VCC	5	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current Per Input Pin	IPIN	100 ± 5	mADC
PWM Duty Ratio	D	100	%
LED Light Bar Test Converter	CMI 27-D041745		

### 5.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 5.2. The following items should be measured under the test conditions described in 5.1 and stable environment shown in Note (5).

Item		Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	Rx		$\theta_x=0^\circ, \theta_Y=0^\circ$ CS-2000 R=G=B=255 Gray scale	Typ – 0.03	0.639	Typ +0.03	-	(1), (5)
		Ry				0.339			
	Green	Gx				0.309			
		Gy				0.619			
	Blue	Bx				0.156			
		By				0.059			
	White	Wx				0.313			
		Wy				0.329			
Center Luminance of White (Center of Screen)		L <sub>C</sub>	2D	250	300	-	cd/m <sup>2</sup>	(4), (5)	
			3D		24		cd/m <sup>2</sup>	(8)	
Contrast Ratio		CR		700	1000	-	-	(2), (5)	
Response Time		T <sub>R</sub>		-	0.8	2.5	ms	(3)	
		T <sub>F</sub>		-	2.6	5.5			
White Variation		δW		$\theta_x=0^\circ, \theta_Y=0^\circ$	-	-	1.42	-	(5), (6)
Crosstalk		CT	3D-W			0.4		%	(8)
			3D-D			12		%	
Viewing Angle	Horizontal	x- +	x+	CR ≥ 10 USB2000	150	170	-	Deg.	(1), (5)
	Vertical	y- +	y+		140	160	-		
Viewing Angle	Horizontal	x- +	x+	CR ≥ 5 USB2000	160	178	---	Deg.	(1), (5)
	Vertical	y- +	y+		150	170	---		
Absorption direction of the up polarizer	Φ <sub>up</sub>	-		-		45	-	Deg.	(7)

Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

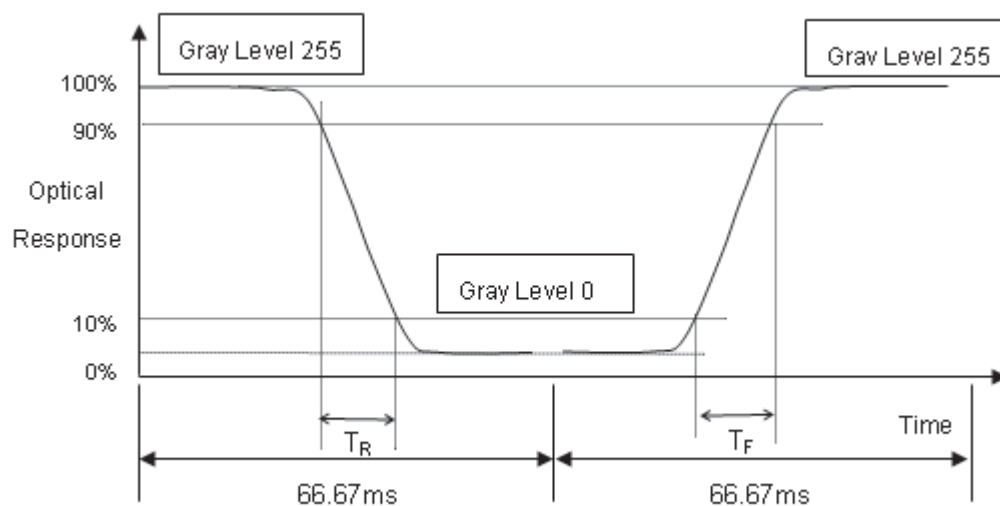
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time ( $T_R$ ,  $T_F$ ):



Note (4) Definition of Luminance of White (LC):

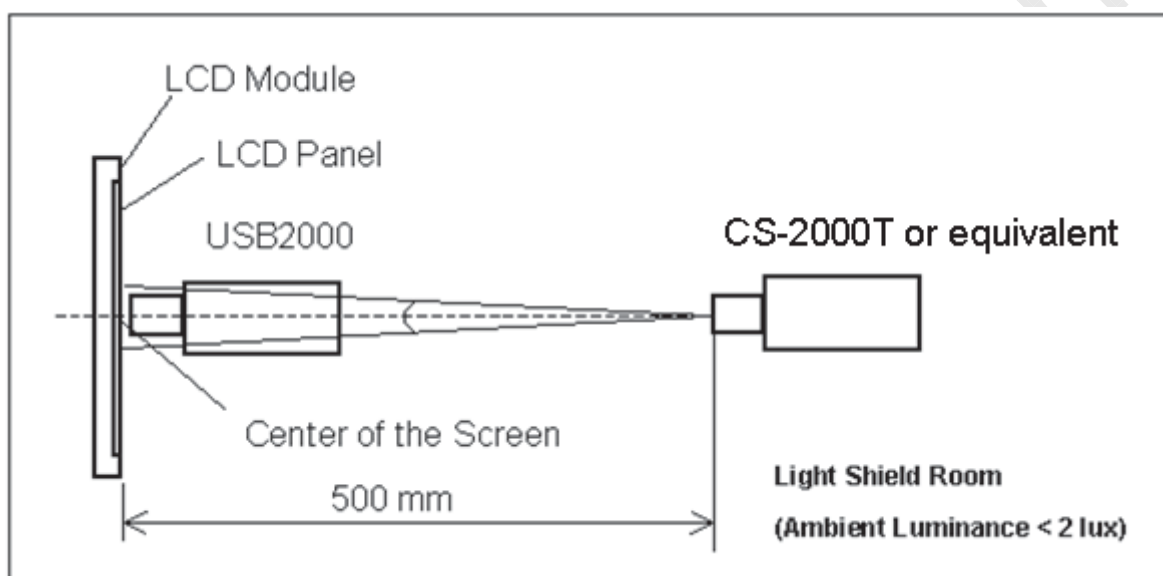
Measure the luminance of gray level 255 at center point

$LC = L(5)$

$L(x)$  is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

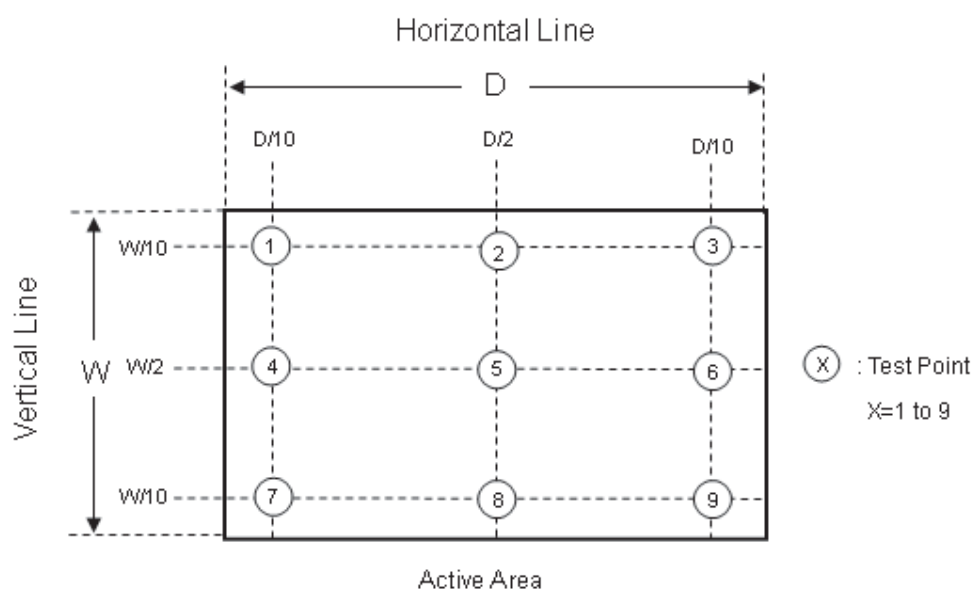
The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.



Note (6) Definition of White Variation ( $\delta W$ ):

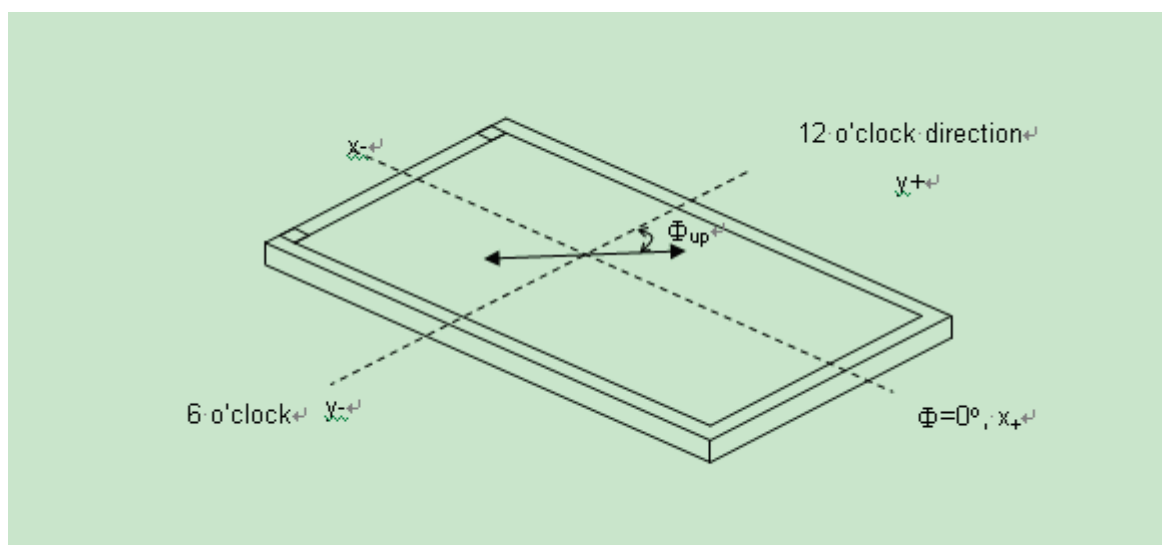
Measure the luminance of gray level 255 at 9 points

$dW = (\text{Minimum } [L(1) \sim L(9)] / \text{Maximum } [L(1) \sim L(9)]) * 100\%$

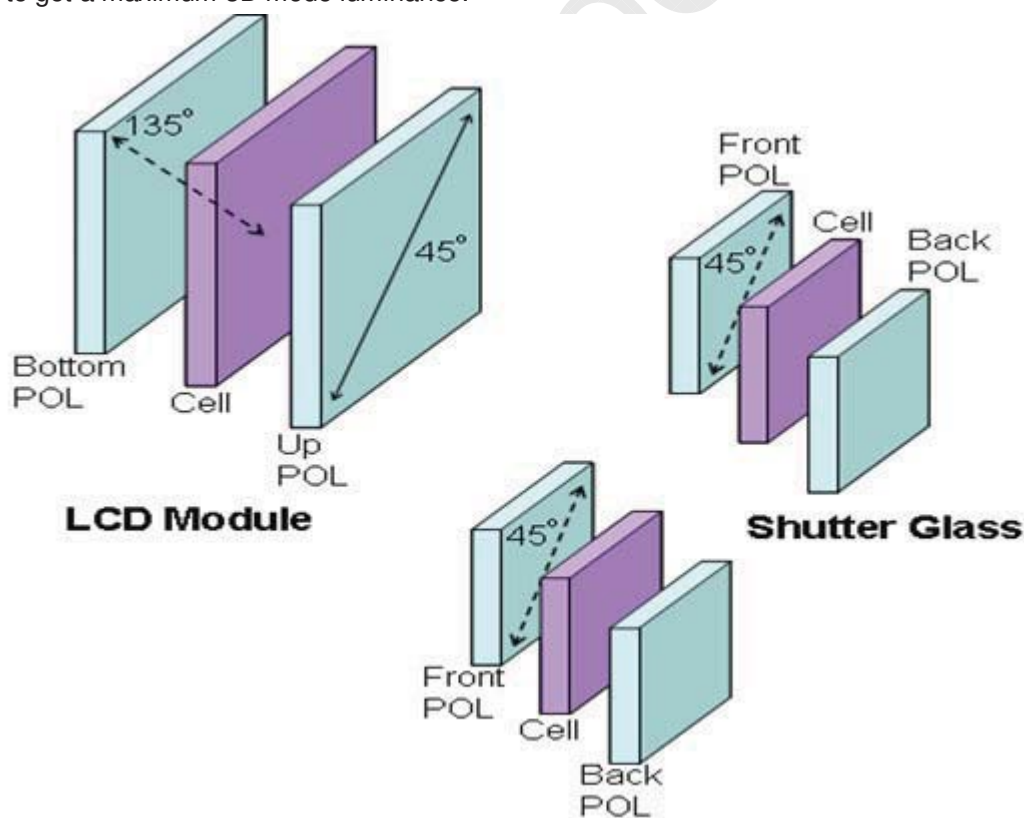


Note (7) This is a reference for designing the shutter glasses of 3D application. (TN case)

Definition of the absorption direction of the up polarizer:



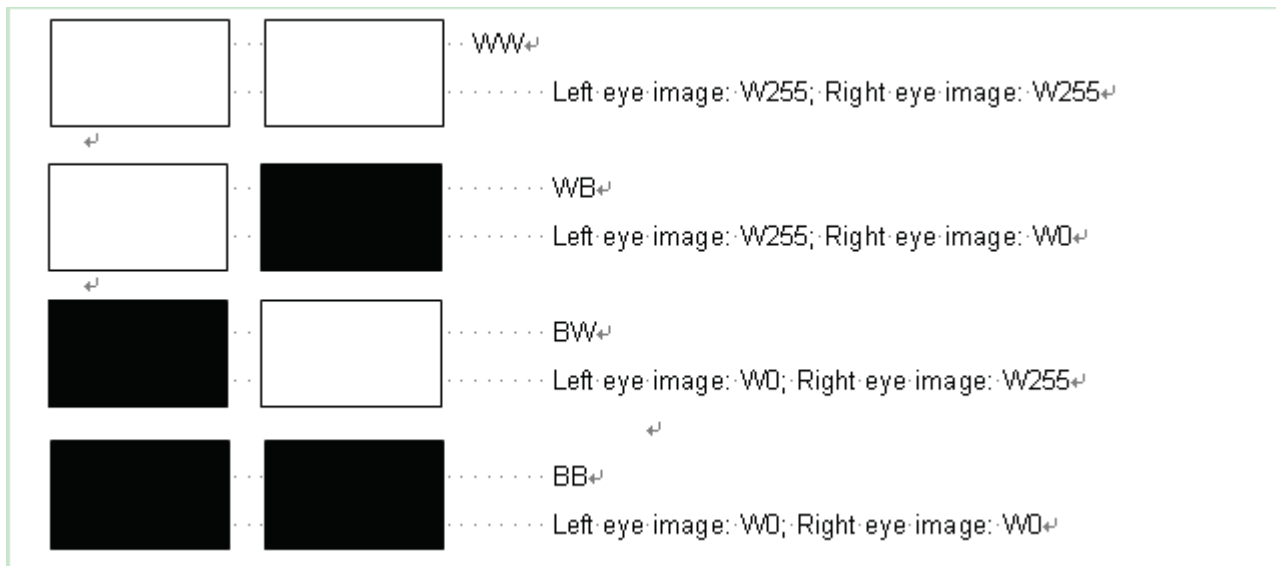
The absorption axis of the front polarizer of the shutter glasses should be parallel to this panel absorption direction to get a maximum 3D mode luminance.



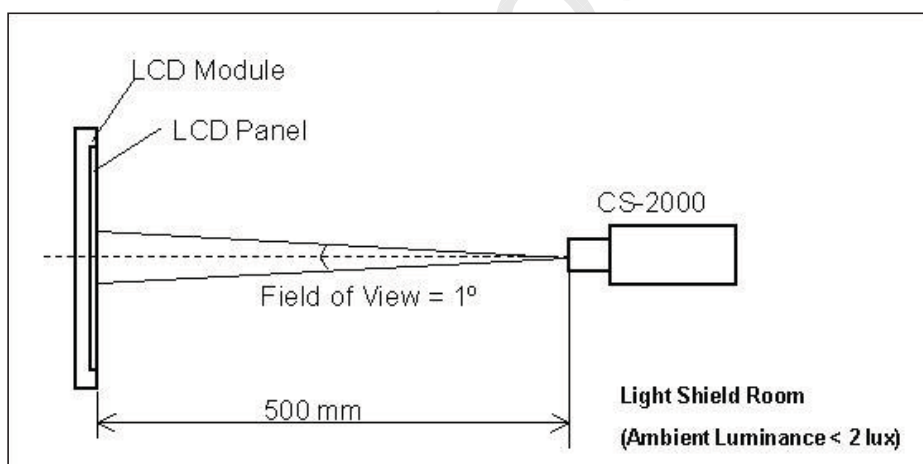
Note(8) Definition of the 3D mode performance (measured under 3D mode):

a. Test pattern

Left eye image and right eye image are displayed alternated



b. Measurement setup



Shutter glasses are well controlled under suitable timing, and measure the luminance of the center point of the panel through the right eye glass. The transmittance of the glass should be larger than 40.0% under 3D mode operation.

The luminance of the test pattern "WW", denoted  $L(WW)$ ; the luminance of the test pattern "WB", denoted  $L(WB)$ ; the luminance of the test pattern "BW", denoted  $L(BW)$ ; the luminance of the test pattern "BB", denoted  $L(BB)$

c. Definition of the Center Luminance of White,  $L_c(3D) : L(WW)$

d. Definition of the 3D mode white crosstalk,  $CT(3D-W) : CT(3D-W) \equiv \frac{L(WB) - L(BB)}{L(WW) - L(BB)}$

Definition of the 3D mode dark crosstalk,  $CT(3D-D) : CT(3D-D) \equiv \frac{L(WW) - L(BW)}{L(WW) - L(BB)}$

**6. RELIABILITY TEST ITEM**

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃ , 80%RH, 240hours	
High Temperature Operation (HTO)	Ta= 50℃ , 50%RH , 240hours	
Low Temperature Operation (LTO)	Ta= 0℃ , 240hours	
High Temperature Storage (HTS)	Ta= 60℃ , 240hours	
Low Temperature Storage (LTS)	Ta= -20℃ , 240hours	
Vibration Test (Non-operation)	Acceleration: 1.5 Grms Wave: Half-sine Frequency: 10 - 300 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 11 ms Direction : ± X, ± Y, ± Z.(one time for each Axis)	
Thermal Shock Test (TST)	-20℃/30min , 60℃ / 30min , 100 cycles	
On/Off Test	25℃ ,On/10sec , Off /10sec , 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω)	
	Air Discharge: ± 15KV, 150pF(330Ω)	
Altitude Test	Operation:10,000 ft / 24hours Non-Operation:30,000 ft / 24hours	

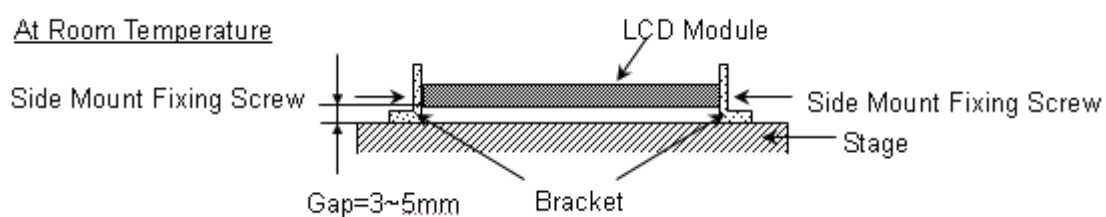
Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:

At Room Temperature



## 7. PACKING

### 7.1 PACKING SPECIFICATIONS

- (1) 7 LCD modules / 1 Box
- (2) Box dimensions: 720(L) X 360(W) X 480(H) mm
- (3) Weight: approximately: 25.83 Kg ( 7 modules per box)

### 7.2 PACKING METHOD

- (1) Carton Packing should have no failure in the following reliability test items.

Test Item	Test Conditions	Note
Vibration	ISTA STANDARD Random, Frequency Range: 1 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Pass
Dropping Test	1 Angle, 3 Edge, 6 Face, TBD 45.7cm	Pass

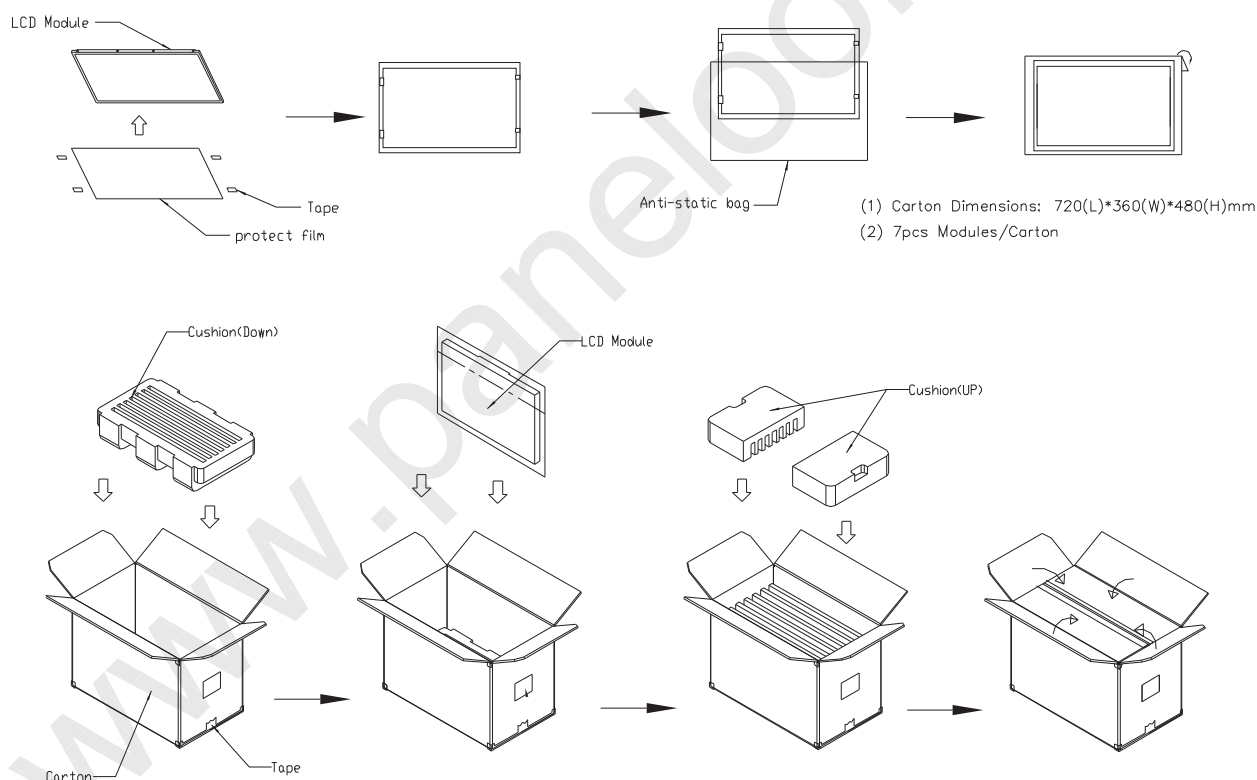
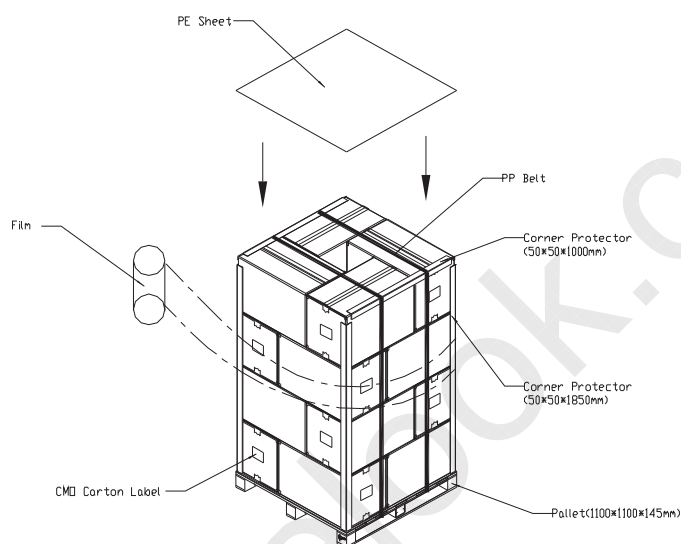


Figure. 7-1 Packing method

**7.3 PALLET**

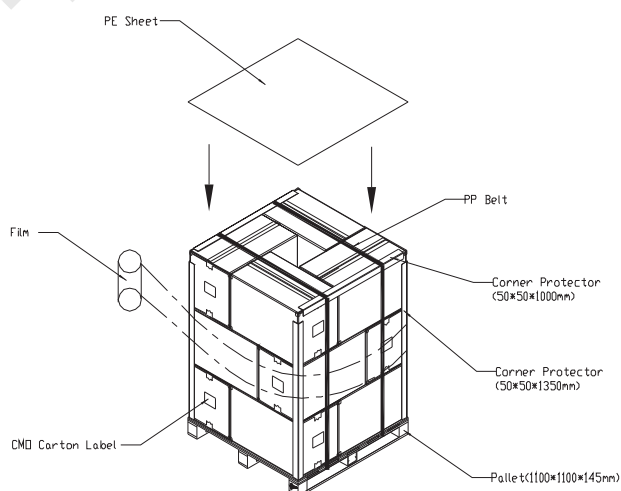
For ocean shipping

Sea and land transportation

**Figure. 7-2 Packing method**

For air transport

Air transportation

**Figure. 7-3 Packing method**

## 8. CMI MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: M270H5-LA2

(b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.

(c) CMI barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

Code	Meaning	Description
XX	CMI internal use	-
XX	Revision	Cover all the change
X	CMI internal use	-
XX	CMI internal use	-
YMD	Year, month, day	Year: 0~9, 2001=1, 2002=2, 2003=3...2010=0, 2011=1, 2012=2... Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U.
L	Product line #	Line 1=1, Line 2=2, Line 3=3, ...
NNNN	Serial number	Manufacturing sequence of product

(d) Customer's barcode definition:

Serial ID: CM-R05A2-X-X-X-XX-L-XX-L-YMD-NNNN

Code	Meaning	Description
CM	Supplier code	CMI=CM
N65A3	Model number	M270H5-LA2= R05A2
X	Revision code	Non ZBD: 1,2,~,8,9 / ZBD: A~Z
X	Source driver IC code	Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatec=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M, ILITEK=Q, Fiti=Y, None IC =Z
X	Gate driver IC code	
XX	Cell location	Tainan Taiwan=TN, Ningbo China=CN, Hsinchu Taiwan=SC
L	Cell line #	1,2,~,9,A,B,~,Y,Z
XX	Module location	Tainan, Taiwan=TN ; Ningbo China=NP, Shenzhen China=SH
L	Module line #	1,2,~,9,A,B,~,Y,Z
YMD	Year, month, day	Year: 0~9, 2001=1, 2002=2, 2003=3...2010=0, 2011=1, 2012=2... Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, T, U, V
NNNN	Serial number	By LCD supplier



(e) FAB ID(UL Factory ID):

Region	Factory ID
TWCMI(LCM2)	(Blank)
TWCMI(LCM4)	GEMN
NBCMI	LEOO
NBCME	CANO
NHCM I	CAPG

## 9. PRECAUTIONS

### 9.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly.

### 9.2 STORAGE PRECAUTIONS

- (1) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0°C to 35°C and relative humidity of less than 70%
- (2) Do not store the TFT – LCD module in direct sunlight
- (3) The module should be stored in dark place. It is prohibited to apply sunlight or fluorescent light in storing

### 9.3 OPERATION PRECAUTIONS

- (1) The LCD product should be operated under normal condition.  
Normal condition is defined as below :  
Temperature : 20±15°C  
Humidity: 65±20%  
Display pattern : continually changing pattern(Not stationary)

- (2) If the product will be used in extreme conditions such as high temperature, high humidity, high altitude ,display pattern or operation time etc...It is strongly recommended to contact CMI for application engineering advice . Otherwise , Its reliability and function may not be guaranteed.

#### 9.4 SAFETY PRECAUTIONS

- (1) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (2) After the module's end of life, it is not harmful in case of normal operation and storage.

#### 9.5 SAFETY STANDARDS

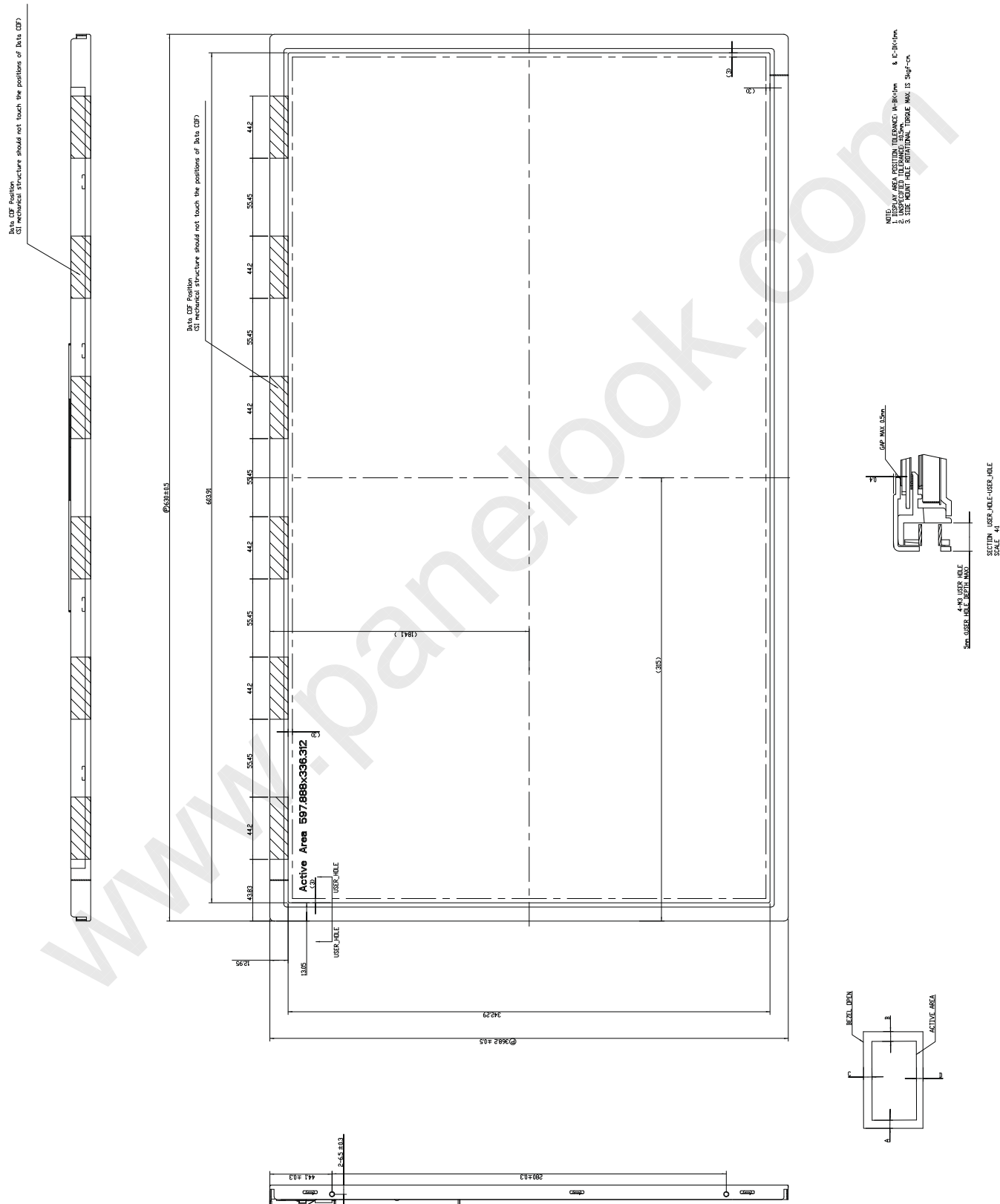
The LCD module should be certified with safety regulations as follows:

Requirement	Standard	remark
UL	UL60950-1:2006 or Ed.2:2007	
cUL/CSA	CAN/CSA C22.2 No.60950-1-03 or 60950-1-07	
CB	IEC60950-1:2005 / EN60950-1:2006+ A11:2009	

#### 9.6 OTHER

When fixed patterns are displayed for a long time, remnant image is likely to occur.

#### Appendix. OUTLINE DRAWING




TITLE	Assy_Moldo_M2705-L42		REV.	4
Approved		Printing No.	M2705-023A	
Decided	THOR DM66	Part No.	110	
Drafter	WROD DEN	Material	ASSY	
Designer	WROD DEN	Date	10-Mar-2011	Scale 1:1
			1/2	1/4
			1/8	1/16
			1/32	1/64
			1/128	1/256
			1/512	1/1024
			1/2048	1/4096
			1/8192	1/16384
			1/32768	1/65536
			1/262144	1/524288
			1/1048576	1/2097152
			1/4194304	1/8388608
			1/16777216	1/33554432
			1/67108864	1/134635392
			1/264435392	1/537740800
			1/1057740800	1/2151001600
			1/4230801600	1/8604006400
			1/16923206400	1/34416025600
			1/67692825600	1/138368102400
			1/270771302400	1/553484417280
			1/1083085248000	1/2213937670400
			1/4332341024000	1/8855750681600
			1/17329364096000	1/35423002726400
			1/69317456384000	1/141692010905600
			1/277270625536000	1/566768043622400
			1/1109082502144000	1/2271472174489600
			1/4436330008576000	1/9085888697958400
			1/17745320034304000	1/36343554791833600
			1/70981280137216000	1/145374219167334400
			1/283925120548864000	1/581506876669337600
			1/1135700482195456000	1/2326027506677350400
			1/4542801928781824000	1/9304110026709401600
			1/18171207315127040000	1/37216440106837606400
			1/72684829260508160000	1/148865760427350425600
			1/290739317042032640000	1/595463041709401702400
			1/1163057268168012800000	1/2381852166837606830400
			1/46522290727120512000000	1/95274086673504273216000
			1/186089162908482048000000	1/38109634669401709440000
			1/744356651633928384000000	1/1524385386776068376960000
			1/29774266065357137920000000	1/60975415471042735042560000
			1/119097064261428549888000000	1/243901663884170944202240000
			1/4763882570457142895360000000	1/975606655536384170944202240000
			1/190555302818285715814400000000	1/390242662214547109442022400000
			1/7622212112714285715337600000000	1/15609706568581837606837696000000
			1/304888484508571428521312000000000	1/62438825704571428521312000000000
			1/1219553858034285714210240000000000	1/2517426606535714285210240000000000
			1/48782154321371428571404800000000000	1/10071665163392857142857140480000000000
			1/1951286172853571428571664000000000000	1/40367065685818376068376960000000000
			1/78051446914285714285716640000000000000	1/1614706622145471094420224000000000000
			1/31220578765714285714285716640000000000000	1/64597065685818376068376960000000000000
			1/12488231506285714285714285716640000000000000	1/26038825704571428571428571664000000000000000
			1/503529260253571428571428571428571664000000000000	1/1051543213714285714285714285716640000000000000
			1/201411704102857142857142857142857142857166400	

Mark	Description	Date	Changed By	Approved By	ECN No.	Remark



TITLE	Assy Module K2705-1A2	REV.	4
Approved	By: JLN	Drawing No.	K2705-003A
Reviewed	By: TIKER, DANG	Part No.	710
Checker	By: MOOR, DEN	Material	ASSY
Designer	By: MOOR, DEN	Date	10-Mar-2011
		Scale	1:1
		Version	00


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 COWI ENGINEERING COMPANY

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